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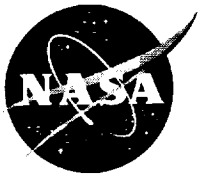

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Jeffrey A. Newcomer, Editors

Volume 13

BOREAS AFM-06 Mean Temperature Profile Data

J. Wilczak

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

June 2000

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BOREAS AFM-6 Mean Temperature Profile Data

James Wilczak

Summary

The BOREAS AFM-6 team from NOAA/ETL operated a 915-MHz wind/Radio Acoustic Sounding System (RASS) profiler system in the SSA near the OJP tower from 21-May-1994 to 20-Sep-1994. The data set provides temperature profiles at 15 heights, containing the variables of virtual temperature, vertical velocity, the speed of sound, and w-bar. The data are stored in tabular ASCII files.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS AFM-06 Mean Temperature Profile Data

1.2 Data Set Introduction

This data set used the National Oceanic and Atmospheric Administration Environment Technology Laboratory (NOAA/ETL) 915-MHz wind/Radio Acoustic Sounding System (RASS) profiler data. Included in this data set are temperature profiles at 15 heights, containing the variables of virtual temperature, vertical velocity, the speed of sound, and w-bar. The data were collected near the BOReal Ecosystem-Atmospheric Study (BOREAS) Southern Study Area (SSA)-Old Jack Pine (OJP) tower site from May to September in 1994.

1.3 Objective/Purpose

The BOREAS Airborne Fluxes and Meteorology (AFM)-06 team's field work objectives were to measure continuous hourly profiles of wind velocity and temperature in the atmospheric boundary layer (ABL) and lower troposphere, to measure the depth of the daytime convective boundary layer, and to measure the occurrence of precipitation, all using a 915-MHz radar wind/RASS profiler. The

data were then to be used to document average boundary layer structure, and especially changes in boundary layer structure during the course of the boreal summer growing season.

1.4 Summary of Parameters

Included in this data set are temperature profiles at 15 heights, containing the variables of virtual temperature, vertical velocity, the speed of sound, and w-bar.

1.5 Discussion

NOAA/ETL operated a 915-MHz wind profiling radar and surface meteorological station near the SSA-OJP continuously from 21-May-1994 through 20-Sep-1994. The data provided by the wind profiler are vertical profiles of wind speed and direction and virtual temperature, as well as boundary layer depth (Zi) and the presence of precipitation. These measurements were made with 100-m vertical resolution with the lowest measurement height at 150 m above ground level (AGL). The maximum height sampled was 3850 m AGL, although on many days the maximum height of the wind measurements was in the range of 2-3 km due to weak signal strength in the region of the lower troposphere above the ABL. Temperature profiles were routinely measured to heights of 500-1000 m.

1.6 Related Data Sets

BOREAS AFM-06 Boundary Layer Heights
BOREAS AFM-06 Surface Meteorological Data
BOREAS AFM-06 Mean Wind Profile Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

Robert Banta, Brooks Martner, James Wilczak NOAA Environmental Laboratory

2.2 Title of Investigation

Outer Boundary Layer Effects on Surface Fluxes of Momentum, Heat, Moisture, and Greenhouse Gases from the Boreal Forest

2.3 Contact Information

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Greenbelt, MD 20771
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(301) 286-0239 (fax)
Jeffrey.Newcomer@gsfc.nasa.gov

3. Theory of Measurements

The above measurements were obtained by measuring the zeroth, first, and second moments of the radar Doppler spectrum. The zeroth moment is the signal power. The range-corrected signal power can alternatively be expressed in terms of the turbulence structure parameter CN2. It is well-known that the vertical profile of CN2 exhibits a sharp peak at the midpoint of the inversion transition region, due to local mixing of relatively cool, moist boundary layer air with warmer and dryer air aloft. Our measurements of Zi were obtained from the peak value in the vertical profile of CN2 from a vertically pointing radar beam. The first moment of the Doppler spectrum is the Doppler velocity. The vertical profile of wind velocity was measured by combining the Doppler velocities measured along three radar beams: one vertical, and two oblique beams pointing at elevations of 75 degrees, oriented 90 degrees apart. The vertical profile of virtual temperature was measured using the RASS, in which an array of acoustic speakers surrounds the radar and generates a sound pulse. The radar signal reflects off of this acoustic wave front, and the measured Doppler shift indicates the velocity of the sound pulse, which is proportional to the virtual temperature of the air. The second moment of the Doppler spectrum, or spectral width, can provide a measure of the strength of the turbulence within the boundary layer. The second moment has not been directly used in the present analysis. Finally, the presence of precipitation is determined by using both signal power and the vertical velocity. Rain and snow have much greater signal power than does clear air, and nearly uniform downward velocities. Rain can be distinguished from snow by its greater reflectivity, and by its greater fall velocity. Because of the high sensitivity of the profiler, it is capable of detecting small amounts of rain that might not be measured by a traditional surface rain gauge. The profiler detects only the presence of precipitation, however, and at present cannot give a quantitative measure of rainfall amount.

4. Equipment

4.1 Sensor/Instrument Description

915-MHz wind profiling radar with RASS.

4.1.1 Collection Environment

The 915-MHz profiler was used during various ambient weather conditions that occurred at the BOREAS SSA-OJP site.

4.1.2 Source/Platform

Ground-based.

4.1.3 Source/Platform Mission Objectives

The ground was used to support the needed instrumentation.

4.1.4 Key Variables

Included in this data set are temperature profiles at 15 heights, containing the variables of virtual temperature, vertical velocity, the speed of sound, and w-bar.

4.1.5 Principles of Operation

Standard Doppler radar techniques.

4.1.6 Sensor/Instrument Measurement Geometry

One vertical beam, two oblique beams 15 degrees from vertical at an elevation of 75 degrees.

4.1.7 Manufacturer of Sensor/Instrument

Wind Profiler: NOAA/ETL (Contact: James Wilczak at the address found in Section 2).

4.2 Calibration

4.2.1 Specifications
None given.

4.2.1.1 Tolerance
None given.

4.2.2 Frequency of Calibration
None given.

4.2.3 Other Calibration Information
None given.

5. Data Acquisition Methods

During the course of 1 hour, the radar makes 18 cycles through each of the three radial beams, averaging for 60 seconds on each beam. These measurements require a total of 54 minutes. Prior to this, the RASS temperature profile is measured on the vertical beam during the first 5 minutes of the hour. During BOREAS, the RASS temperature observations consisted of 15 measurements, each 15 seconds in length. Each of these individual radial measurements of both wind and temperature is then quality controlled through an automated pattern recognition scheme, and then the measurements are combined into a single value of wind and temperature reported for each hour.

6. Observations

6.1 Data Notes
The wind profiler operated unattended for most of the 4-month observation period.

6.2 Field Notes
The wind profiling radar and surface meteorological stations were located at a site 1.0 km south and 1.6 km east of the OJP tower flux site. The radar site was in a clearing in the jack pine forest, with fetches (clear distances) of 200 m to the north, 500 m to the south, 150 m to the east, and 1 km to the west. Ground cover within the clearing consisted of grass, brush, and young jack pine trees, approximately 1-2 m tall.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage
The North American Datum of 1983 (NAD83) coordinates of the site are:

```
Lat.    =  53.91 °N
Long.   =  104.40 °W
Alt.    =  511 m above sea level
```

This location is 1.0 km south, and 1.6 km east of the SSA-OJP flux tower.

7.1.2 Spatial Coverage Map
Not available.

7.1.3 Spatial Resolution

```
Beamwidth =  9.9 degrees (one-way, 3 dB)
Range resolution = 101 m
Range limits  = 0.112-3.889 km AGL (38 range gates)
```

7.1.4 Projection

Not applicable.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Measurements were made from 21-May-1994 through 20-Sep-1994.

7.2.2 Temporal Coverage Map

Not available

7.2.3 Temporal Resolution

Measurements were made 15 times per hour during the period.

7.3 Data Characteristics

7.3.1 Parameter/Variable

The parameters contained in the data files on the CD-ROM are:

```
         Column Name
------------------------------
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
HT_ASL
VIRT_TEMP
VERT_VELOC
SPEED_OF_SOUND
MEAN_VERT_VELOC
CONSEN_NUM_VIRT_TEMP
SNR_VIRT_TEMP
CONSEN_NUM_VERT_VELOC
SNR_VERT_VELOC
NUM_LVLS
QUAL_CONTROL
CRTFCN_CODE
REVISION_DATE
```

7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the data files on the CD-ROM are:

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were collected.
HT_ASL	The height above mean sea level at which the measurements were taken.
VIRT_TEMP	The measured virtual temperature, with a correction for vertical velocity.
VERT_VELOC	The measured vertical velocity.
SPEED_OF_SOUND	The measured speed of sound.
MEAN_VERT_VELOC	The measured mean vertical velocity.
CONSEN_NUM_VIRT_TEMP	Consensus number on virtual temperature.
SNR_VIRT_TEMP	The signal to noise ratio for virtual temperature.
CONSEN_NUM_VERT_VELOC	Consensus number on vertical velocity.
SNR_VERT_VELOC	The signal to noise ratio for vertical velocity.
NUM_LVLS	The number of height levels in the atmospheric profile.
QUAL_CONTROL	A quality control parameter. A value of 0 or 1 can be considered good. A value of 7 or 8 indicates suspect or bad data: QC Code Definition: 0 --- Valid 1 --- Estimated 7 --- Suspect 8 --- Invalid
CRTFCN_CODE	The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

For the columns VIRT_TEMP, VERT_VELOC, SPEED_OF_SOUND, MEAN_VERT_VELOC, CONSEN_NUM_VIRT_TEMP, SNR_VIRT_TEMP, CONSEN_NUM_VERT_VELOC, SNR_VERT_VELOC the following data definitions apply:

```
Data Code Definition:   -940 --- Failed QC,
                        -950 --- Failed Consensus
                        -960 --- Exceeded Nyquist Vel.
                        -980 --- Flagged by Reviewer
                        -999 --- Missing or Not Reported
```

7.3.3 Unit of Measurement

The measurement units for the parameters contained in the data files on the CD-ROM are:

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
HT_ASL	[meters]
VIRT_TEMP	[degrees Celsius]
VERT_VELOC	[meters][second^-1]
SPEED_OF_SOUND	[meters][second^-1]
MEAN_VERT_VELOC	[meters][second^-1]
CONSEN_NUM_VIRT_TEMP	[unitless]
SNR_VIRT_TEMP	[unitless]
CONSEN_NUM_VERT_VELOC	[unitless]
SNR_VERT_VELOC	[unitless]
NUM_LVLS	[unitless]
QUAL_CONTROL	[unitless]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

7.3.4 Data Source

The sources of the parameter values contained in the data files on the CD-ROM are:

Column Name	Data Source
SITE_NAME	[Assigned by BORIS]
SUB_SITE	[Assigned by BORIS]
DATE_OBS	[Supplied by NOAA/ETL]
TIME_OBS	[Supplied by NOAA/ETL]
HT_ASL	[Supplied by NOAA/ETL]
VIRT_TEMP	[Supplied by NOAA/ETL]
VERT_VELOC	[Supplied by NOAA/ETL]
SPEED_OF_SOUND	[Supplied by NOAA/ETL]
MEAN_VERT_VELOC	[Supplied by NOAA/ETL]
CONSEN_NUM_VIRT_TEMP	[Supplied by NOAA/ETL]
SNR_VIRT_TEMP	[Supplied by NOAA/ETL]
CONSEN_NUM_VERT_VELOC	[Supplied by NOAA/ETL]
SNR_VERT_VELOC	[Supplied by NOAA/ETL]
NUM_LVLS	[Supplied by NOAA/ETL]
QUAL_CONTROL	[Supplied by NOAA/ETL]
CRTFCN_CODE	[Assigned by BORIS]
REVISION_DATE	[Assigned by BORIS]

7.3.5 Data Range

The following table gives information about the parameter values found in the data files on the CD-ROM.

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SITE_NAME	SSA-OJP-RDR01	SSA-OJP-RDR01	None	None	None	None
SUB_SITE	AFM06-RDR01	AFM06-RDR01	None	None	None	None
DATE_OBS	21-MAY-94	21-SEP-94	None	None	None	None
TIME_OBS	5	2305	None	None	None	None
HT_ASL	639	2109	None	None	None	None
VIRT_TEMP	-950	33.3	-999	None	None	None
VERT_VELOC	-950	23.9	-999	None	None	None
SPEED_OF_SOUND	-950	950	None	None	None	None
MEAN_VERT_VELOC	-950	950	None	None	None	None
CONSEN_NUM_VIRT_TEMP	-950	16	None	None	None	None
SNR_VIRT_TEMP	-950	18	None	None	None	None
CONSEN_NUM_VERT_ VELOC	-950	16	None	None	None	None
SNR_VERT_VELOC	-950	36	None	None	None	None
NUM_LVLS	15	15	None	None	None	None
QUAL_CONTROL	0	7	None	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	22-AUG-96	22-AUG-96	None	None	None	None

Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value -- The value that indicates missing data. This is used to indicate that an attempt was made to determine the parameter value, but the attempt was unsuccessful.
Unrel Data Value -- The value that indicates unreliable data. This is used to indicate an attempt was made to determine the parameter value, but the value was deemed to be unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the instruments detection limits. This is used to indicate that an attempt was made to determine the parameter value, but the analysis personnel determined that the parameter value was below the detection limit of the instrumentation.
Data Not Cllctd -- This value indicates that no attempt was made to determine the parameter value. This usually indicates that BORIS combined several similar but not identical data sets into the same data base table but this particular science team did not measure that parameter.

Blank -- Indicates that blank spaces are used to denote that type of value.
N/A -- Indicates that the value is not applicable to the respective column.
None -- Indicates that no values of that sort were found in the column.

7.4 Sample Data Record

The following are wrapped versions of data records from a sample data file on the CD-ROM.

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,HT_ASL,VIRT_TEMP,VERT_VELOC,SPEED_OF_SOUND,
MEAN_VERT_VELOC,CONSEN_NUM_VIRT_TEMP,SNR_VIRT_TEMP,CONSEN_NUM_VERT_VELOC,
SNR_VERT_VELOC,NUM_LVLS,QUAL_CONTROL,CRTFCN_CODE,REVISION_DATE
'SSA-OJP-RDR01','AFM06-RDR01',21-MAY-94,5,639,-999.0,1.69,332.35,-1.19,12,-11,
14,2,15,7,'CPI',22-AUG-96
'SSA-OJP-RDR01','AFM06-RDR01',21-MAY-94,5,744,-999.0,1.28,332.1,-1.12,13,-2,14,
10,15,7,'CPI',22-AUG-96
'SSA-OJP-RDR01','AFM06-RDR01',21-MAY-94,5,954,-999.0,.08,331.38,-1.04,14,-15,14,
5,15,7,'CPI',22-AUG-96
```

8. Data Organization

8.1 Data Granularity

The smallest unit of data tracked by the BOREAS Information System (BORIS) was the data collected at a given site on a given date.

8.2 Data Format(s)

The Compact Disk-Read-Only Memory (CD-ROM) files contain American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

9. Data Manipulations

9.1 Formulae

9.1.1 Derivation Techniques and Algorithms

None given.

9.2 Data Processing Sequence

9.2.1 Processing Steps

During the course of 1 hour, the radar makes 18 cycles through each of the three radial beams, averaging for 60 seconds on each beam. These measurements require a total of 54 minutes. Prior to this, the RASS temperature profile is measured on the vertical beam during the first 5 minutes of the hour. During BOREAS, the RASS temperature observations consisted of 15 measurements, each 15 seconds in length. Each of these individual radial measurements of both wind and temperature is then quality controlled through an automated pattern recognition scheme, and then the measurements are combined into a single value of wind and temperature reported for each hour.

9.2.2 Processing Changes

None given.

9.3 Calculations

9.3.1 Special Corrections/Adjustments
None given.

9.3.2 Calculated Variables
None given.

9.4 Graphs and Plots
None given.

10. Errors

10.1 Sources of Error
During spring and autumn seasons, it is possible that the profiler winds can be contaminated by the presence of migrating birds. These errors are now well understood, and can be recognized from large values of signal power, spectral width, and sudden changes in wind speed occurring near sunset and sunrise. Periods of contaminated winds have been hand edited from the data set. Birds do not directly affect RASS temperatures, although they could have a secondary effect by contaminating vertical velocity, which is used to correct RASS temperatures. No corrections for contaminated vertical velocities on RASS have been made.

10.2 Quality Assessment

10.2.1 Data Validation by Source
See Section 10.2.3.

10.2.2 Confidence Level/Accuracy Judgment
See Section 10.2.3.

10.2.3 Measurement Error for Parameters
During the first 3 days and last 3 days of operation, ETL personnel were at the site taking balloon intercomparisons. These assessments have shown typical values of agreement of the balloons with profiler, typically 1-2 m/s and 1 deg C. Wind velocity differences between 915-MHz wind profilers and precision research aircraft have been found to be on the order of 0.9 m/s.

10.2.4 Additional Quality Assessments
None given.

10.2.5 Data Verification by Data Center
BORIS personnel verified that the delivered data agreed with the information provided by the AFM-06 team.

11. Notes

11.1 Limitations of the Data
None given.

11.2 Known Problems with the Data
None given.

11.3 Usage Guidance
None given.

11.4 Other Relevant Information
None given.

12. Application of the Data Set

These data can be used with the other AFM-06 SSA-OJP data to observe the dynamics of the local atmosphere.

13. Future Modifications and Plans

None given.

14. Software

14.1 Software Description
None given.

14.2 Software Access
None given.

15. Data Access

The mean temperature profile data are available from the Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

15.1 Contact Information
For BOREAS data and documentation please contact:

ORNL DAAC User Services
Oak Ridge National Laboratory
P.O. Box 2008 MS-6407
Oak Ridge, TN 37831-6407
Phone: (423) 241-3952
Fax: (423) 574-4665
E-mail: ornldaac@ornl.gov or ornl@eos.nasa.gov

15.2 Data Center Identification
Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics http://www-eosdis.ornl.gov/ [Internet Link].

15.3 Procedures for Obtaining Data
Users may obtain data directly through the ORNL DAAC online search and order system [http://www-eosdis.ornl.gov/] and the anonymous FTP site [ftp://www-eosdis.ornl.gov/data/] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

15.4 Data Center Status/Plans

The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

16. Output Products and Availability

16.1 Tape Products

None.

16.2 Film Products

None.

16.3 Other Products

These data are available on the BOREAS CD-ROM series.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

Angevine, W.M. and J.I. MacPherson. 1995. Comparison of wind profiler and aircraft wind measurements at Chebogue Point, Nova Scotia. J. Atmos. Ocean. Technol. 12(2), 421 426.

Angevine, W.M. and W.L. Ecklund. 1994. Errors in radio acoustic sounding of temperature. J. Atmos. Ocean. Technol. 11, 42 49.

Gage, K.S., C.R. Williams, and W.L. Ecklund. 1994. UHF wind profilers: A new tool for diagnosing tropical convective cloud systems. Bull. Amer. Meteor. Soc. 75, 2289 2294.

Gossard, E.E. and R.G. Strauch. 1983. Radar observations of clear air and clouds. Elsevier, Amsterdam, 280 pp.

May, P.T., K.P. Moran, and R.G. Strauch. 1989. The accuracy of RASS temperature measurements. J. Appl. Meteor. 28, 1329 1335.

Moran, K.P. and R.G. Strauch. 1994. The accuracy of RASS temperature measurements corrected for vertical air motion. J. Atmos. Ocean. Technol. 11, 995 1001.

Peters, G. 1994. Correction of turbulence induced errors of RASS temperature profiles. Proc., 3rd Intl Symp. on Tropospheric Profiling: Needs and Technologies, Hamburg, Max Planck-Gesellschaft zur Förderung der Wissenschaften, pp. 266 268.

17.2 Journal Articles and Study Reports

Angevine, W.M., A.B. White,, and S.K. Avery. 1994b. Boundary-layer depth and entrainment zone characterization with a boundary-layer profiler, Boundary-Layer Meteorol. 68, 375 385.

May, P.T. and J.M. Wilczak. 1993. Diurnal and seasonal variations of boundary layer structure observed with a radar wind profiler and RASS. Mon. Wea. Rev. 121, 673 682.

Merritt, D.A. 1995. A statistical averaging method for wind profiler Doppler spectra. J. Atmos. Ocean. Technol. (accepted for publication).

Newcomer, J., D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers, eds. 2000. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM.

Ralph, F.M. 1995. Using radar-measured radial vertical velocities to distinguish precipitation scattering from clear-air scattering, J. Atmos. Ocean. Technol. 12, 257 267.

Rogers, R.R., W.L. Ecklund, D.A. Carter, K.S. Gage, and S.A. Ethier. 1993. Research applications of a boundary-layer wind profiler, Bull. Amer. Meteor. Soc. 74, 567 580.

Sellers, P. and F. Hall. 1994. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1994-3.0, NASA BOREAS Report (EXPLAN 94).

Sellers, P. and F. Hall. 1996. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1996-2.0, NASA BOREAS Report (EXPLAN 96).

Sellers, P., F. Hall, and K.F. Huemmrich. 1996. Boreal Ecosystem-Atmosphere Study: 1994 Operations. NASA BOREAS Report (OPS DOC 94).

Sellers, P., F. Hall, and K.F. Huemmrich. 1997. Boreal Ecosystem-Atmosphere Study: 1996 Operations. NASA BOREAS Report (OPS DOC 96).

Sellers, P., F. Hall, H. Margolis, B. Kelly, D. Baldocchi, G. den Hartog, J. Cihlar, M.G. Ryan, B. Goodison, P. Crill, K.J. Ranson, D. Lettenmaier, and D.E. Wickland. 1995. The boreal ecosystem-atmosphere study (BOREAS): an overview and early results from the 1994 field year. Bulletin of the American Meteorological Society. 76(9):1549-1577.

Sellers, P.J., F.G. Hall, R.D. Kelly, A. Black, D. Baldocchi, J. Berry, M. Ryan, K.J. Ranson, P.M. Crill, D.P. Lettenmaier, H. Margolis, J. Cihlar, J. Newcomer, D. Fitzjarrald, P.G. Jarvis, S.T. Gower, D. Halliwell, D. Williams, B. Goodison, D.E. Wickland, and F.E. Guertin. 1997. BOREAS in 1997: Experiment Overview, Scientific Results and Future Directions. Journal of Geophysical Research 102(D24): 28,731-28,770.

Whiteman, C.D. and X. Bian. 1994. Semidiurnal solar tides in the mountain atmosphere. Proc., 23rd Conf. on Alpine Meteorology (Lindau, Germany), Deutsche Wetterdienst, Offenbach, Germany.

Wilczak, J.M., R.G. Strauch, F.M. Ralph, B.L. Weber, D.A. Merritt, J.R. Jordan, D.E. Wolfe, L.K. Lewis, D.B. Wuertz, J.E. Gaynor, S.A. McLaughlin, R.R. Rogers, A.C. Riddle, and T.S. Dye. 1995. Contamination of wind profiler data by migrating birds: Characteristics of corrupted data and potential solutions. J. Atmos. Ocean. Technol. 12, 449 467.

17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

ABL	- Atmospheric Boundary Layer
AFM	- Airborne Fluxes and Meteorology
ASCII	- American Standard Code for Information Interchange
BOREAS	- BOReal Ecosystem-Atmosphere Study
BORIS	- BOREAS Information System
CD-ROM	- Compact Disk - Read-Only Memory
DAAC	- Distributed Active Archive Center
EOS	- Earth Observing System
EOSDIS	- EOS Data and Information System
ETL	- Environment Technology Laboratory
GIS	- Geographic Information System
GMT	- Greenwich Mean Time
GSFC	- Goddard Space Flight Center
HTML	- HyperText Markup Language
NAD83	- North American Datum of 1983
NASA	- National Aeronautics and Space Administration
NOAA	- National Oceanic and Atmospheric Administration
NSA	- Northern Study Area
OJP	- Old Jack Pine
ORNL	- Oak Ridge National Laboratory
PANP	- Prince Albert National Park
RASS	- Radio Acoustic Sounding System
SSA	- Southern Study Area
URL	- Uniform Resource Locator

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The BOREAS AFM-6 team from NOAA/ETL operated a 915-MHz wind/Radio Acoustic Sounding System (RASS) profiler system in the SSA near the OJP tower from 21-May-1994 to 20-Sep-1994. The data set provides temperature profiles at 15 heights, containing the variables of virtual temperature, vertical velocity, the speed of sound, and w-bar. The data are stored in tabular ASCII files.

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